



October 26, 2006

Mr. James Wasilak  
Director, City of Rockville Planning Department  
111 Maryland Avenue  
Rockville, MD 20850

Re: T Mobile Application SPX 2005-00364  
Hearing Dates—November 15<sup>th</sup> (Planning Commission)  
December 2<sup>nd</sup> (Board of Appeals)

Dear Mr. Wasilak:

On behalf of the applicant, please accept the following material in support of the referenced application. We are also delivering a complete set of these materials to City's consultant, Columbia Telecommunications, as requested by staff.

1. Revised, Final Plans: By letter dated September 28, 2006, we advised that T Mobile has agreed to amend the referenced application to reduce the proposed height of the monopole to fifty feet (50'). Accordingly, we are providing plans that show this change. The plans also show the proposed access route and the reforestation area. [Exhibit A].
2. Property Value Impact Report: It has been suggested by some of the residents that the proposed facility will have an adverse impact on property values for homes in close proximity to the site. Enclosed is a report prepared by Oakleigh Thorne, an acknowledge expert in the field of property valuation that addresses this issue. Mr. Thorne's qualifications are included in this report as well. Mr. Thorne will use this report as the basis for his testimony before the Planning Commission and Board of Appeals. [Exhibit B].
3. RF Exposure Study: T Mobile submitted a Radio-Frequency (RF) Emissions Report in the initial application filed with the City. However, with the reconfiguration of the site, T Mobile had its' engineer prepare a revised RF Emissions Report, which is attached as Exhibit C.

4. RF Propagation Maps and Drive Test Data: The City and its consultant have already reviewed the RF propagation maps and drive test data compiled by T Mobile. However, staff has asked us to file copies of all such materials we intend to use at the hearings. Enclosed and marked as Exhibit D is a copy of this material. We will also send this electronically as requested by staff.
5. Photos: Enclosed are a number of photos and photo simulations we had prepared. Please be advised that the height simulated here was 70 feet, as was originally proposed. When the height is reduced to 50 feet, the visibility of the facility will be further diminished. [Exhibit E].
6. Resumes of RF Engineers: Enclosed are copies of two of the T Mobile engineers who have worked on the design of the site, and know the objectives, are familiar with the site and its relationship to the network. One or both of these will be called as a witness during the hearings. [Exhibit F].

We believe this application meets all criteria under the code and applicable caselaw in the State of Maryland, and we look forward to our hearing on this matter.

Sincerely,

  
Edward L. Donohue

Copies: Doug Breisch  
Cas Chasten  
Bob Hunnicutt

## EXHIBIT "B"

**MONOPOLE IMPACT OPINION**  
**ON RESIDENTIAL REAL ESTATE PRICES**  
**FOR**

**HOMES NEAR**  
**651 GREAT FALLS ROAD**  
**ROCKVILLE**  
**MONTGOMERY COUNTY, MD 20850**

**REPORT DATE:**  
October 19, 2006

**PREPARED FOR:**  
Mr. Ed Donohue  
Donohue & Blue PLC  
801 North Fairfax Street, Suite 209  
Alexandria, Virginia 22314

**PREPARED BY:**  
**THORNE CONSULTANTS, INC.**  
10605 Concord Street, Suite 420  
Kensington, MD 20895  
TEL: (301) 231-4700 FAX: (301) 231-4704  
[thorneconsultants@eurekaimail.net](mailto:thorneconsultants@eurekaimail.net)

October 19, 2006

Mr. Ed Donohue  
Donohue & Blue PLC  
801 North Fairfax Street, Suite 209  
Alexandria, Virginia 22314

Re: Proposed Construction of an  
Unmanned Wireless Communication Device (WAN143C)  
By T-Mobile (50-foot Monopole) at the  
Julius West Middle School  
651 Great Falls Road  
Rockville, Montgomery County, MD 20850

Mr. Donohue:

In response to your request, we analyzed T-Mobile Northeast LLC Wireless PCS's proposed construction of a 50-foot telecommunications device at 651 Great Falls Road, Rockville, Montgomery County, Maryland. The purpose of this communication facility is to broaden T-Mobile's coverage area. The new unmanned wireless equipment shelter and monopole are proposed for a large tract containing about 21.31 acres.

Our assignment was to determine whether, in our opinion, there would be any negative impact on the economic value of surrounding properties or the general neighborhood at the subject site. As explained herein, we concluded that the proposed pole will not have a negative economic impact.

#### The Property

The scope of the project consists of the installation of a proposed 50-foot monopole facility with nine panel antennas. The placement of three ground-based equipment cabinets on a 10' x 20' concrete pad will be next to the monopole. The facility will be located inside a 50' x 20' gravel compound area surrounded by a chain link fence with a four-foot-wide main gate.

Once the site is constructed and equipment is located on the premises, technicians will visit the site one to two times per month to perform routine maintenance. Access to the proposed compound will be provided by a narrow single-lane service road adjacent to Great Falls Road. The same road serves the athletic fields used by the middle school. There will be no hazardous materials stored at the completely unmanned facility.

The Julius West Middle School site is a very large property for the neighborhood, consisting of 21.31 acres (according to the Maryland Department of Assessment and Taxation website) located in the northeast corner of the intersection of Great Falls Road and I-270. The frontage along I-270 is heavily wooded, and a minimal tree buffer is found along the north side of Great Falls Road.

The site, besides its large land area, offers a number of benefits:

- ☐ The proposed pole is oriented toward and faces I-270.
- ☐ The nearest residential homes are found at Blaze Climber Way about 500 to 600 feet to the northeast of the proposed site.
- ☐ The school board plans to reforest the perimeter of a number of existing school properties including Julius West Middle School.; this effort will further shield the property from view.
- ☐ The compound and the pole are located in a dense cluster of trees in the western corner of the school.
- ☐ Homes on the west side of I-270 at Woodsend Place and Woodsend Court will not be impacted by a view of the proposed pole as elevation differences and tree cover prevent visual contact.
- ☐ The proposed pole's height is 50 feet leaving only the top few feet visible from the dozen or so homes located on Blaze Climber Way; moreover, these town homes are oriented toward the school building's northwest elevation, not toward the pole (refer to the aerial photograph following this page).
- ☐ From Blaze Climber Way, the noise generated by cars and trucks on I-270 is overwhelming and trumps any claim of negative visual impact by the presence of a monopole structure; moreover, due to elevation characteristics, highway sign structures and lighting at the intersection of Great Falls Road and I-270 are higher than the proposed pole and more of an intrusion in the view shed.

#### Neighborhood Description

The property and the proposed monopole are found in the center of a densely developed subarea less than a half mile southwest of Rockville's city center. The neighborhood is found between Route 355 at the east and I-270 at the west. The southern half of Rockville is almost completely developed with housing found in numerous subdivisions. The housing stock is in good condition despite the age of many homes. The demand for homes in this convenient area has always been superior to other county locations.

Photographs of the proposed site and market area housing stock follow this letter report. We also have enclosed a copy of a peer-reviewed study reporting the effect of wireless communication structures on adjacent homes in Richmond, VA. The authors of this published article found that several poles and a lattice tower had no impact on property values.

#### Research and Studies

Since 1996, our firm has conducted eleven studies (on eight individual sites) involving communication installations and the impact, if any, on adjacent property prices. The wireless communication devices included tall monopoles (from 100 to 200 feet), lattice towers with guy wire supports (from 200 to 225 feet), and water towers with antennas. All installations included equipment buildings of various heights and dimensions. Our cellular impact studies are listed in the table on the following page.

In our prior study areas, homes within view of existing towers and related equipment buildings were as near as 175 feet (e.g., at the Bullis School site) of the communication device. Most homes, however, were about 300 to 500 feet from the communication antennas and buildings. We studied cell pole sites at the Hunt @ Fairfax Station twice and the Bullis School on three occasions as increased sales activity provided additional supporting evidence. The multiple studies of the Bullis School monopole and its equipment shed revealed that luxury housing prices were not affected by the presence of the communication equipment. The results of all our studies have been consistent in that we found no discernable negative economic impact due to the presence of these facilities on adjacent properties.

MONOPOLE, CELL TOWER and WATER TOWER STUDIES				
#	STUDY NAME	LOCATION (County & State)	TYPICAL HOME PRICES	STUDY DATES
1, 2, 3	Bullis School	Montgomery County, MD	\$1.2 - \$2.5 million	4/96 6/98 5/01
4	Clearview Estates	Howard County, MD	\$250,000 - \$400,000	4/96
5, 6, 7	Eastern Shore	Kent & Queen Anne Counties, MD (Three tall lattice towers)	\$60,000 - \$125,000	4/99
8	Bas Yavok School for Girls	Owings Mills Baltimore County, MD	\$240,000 - \$375,000	10/97
9, 10	Hunt @ Fairfax Station	Fairfax County, VA	\$400,000 - \$600,000	3/96 7/97
11	Hampshire Greens	Three Water Towers w/Communication Equipment Montgomery County, MD	\$500,000 - \$700,000	11/00

We studied home sale activity in zip codes 20850 (east side of I-270) and 20854 (west side of I-270) to determine the relationship of residential prices in the subject's market area to home prices in our study group. The home sale activity study concentrated on homes near the intersection of I-270 and Great Falls Road. Particular attention was directed to the northeast quadrant of the intersection as these homes are nearest the proposed site.

We searched Maryland's Department of Assessments and Taxation database and MATRIX (Metropolitan Regional Information Systems) for sales and listing information on homes in the vicinity of Great Falls Road and I-270. The results of the search are found in the addenda and include 56 home sales from January 2004 to June 2006.

A wide range of prices is revealed in the 56 sales; however, the most frequent occurrence falls in a range between \$500,000 to \$650,000. These sales reflect homes on small lots and/or town homes in a densely populated area. Four of the 56 homes sales exceeded prices above \$1,000,000. The character of the housing stock is very similar to our studies at the Bullis School and at Hampshire Green.

In all our studies, we never encountered a home owner who considered a view of a communication device (e.g., monopole, lattice tower or water tower with communication equipment) as a motivation to offer a lower than market price for a home with such a view. The empirical evidence based on in-depth analysis of sales and interviews with home owners near monopoles suggests that these devices are considered part of the communication infrastructure which, once constructed, are ignored.

#### Conclusion

It is our opinion, based on our local area study and the well-supported conclusions obtained from our research at other similar monopole sites, that the proposed 50-foot monopole will not have a negative economic impact on surrounding properties or the general neighborhood at the subject site. Moreover, several of our studies included homes similar in suburban character and pricing to the homes proximate to T-Mobile's proposed site at 651 Great Falls Road.

Sincerely,  
**THORNE CONSULTANTS, INC.**

Oakleigh J. Thorne, CRE, MAI  
Certified General Real Estate Appraiser  
State of Maryland #1956

## EXHIBIT "C"

**ENGINEERING STATEMENT  
RADIO-FREQUENCY EXPOSURE STUDY  
JULIUS WEST MIDDLE SCHOOL  
651 GREAT FALLS ROAD  
ROCKVILLE, MARYLAND**

Pursuant to a request from T-Mobile Wireless ("T-Mobile"), also referred to as Omnipoint Communications CAP Operations, LLC, an analysis has been made of the radio-frequency ("RF") exposure in the vicinity of the proposed base station at the Julius West Middle School 651 Great Falls Road, Rockville, Maryland. This engineering statement describes the results of the analysis and the methodology employed.

Wireless Communications Service radio installations, such as that proposed by T-Mobile, are environmentally benign. They are compliant with the RF exposure standards adopted by the Federal Communications Commission ("FCC") and do not constitute a health hazard. They are not a potential source of interference to television or radio broadcast station reception or to electrical or electronic devices. They are neither a noise source nor a generator of traffic, nor do they emit noxious fumes.

T-Mobile proposes to install a 50-foot tall monopole approximately 600 feet west of the closest point on the school. The monopole will support the base station antennas centered at the 47-foot level. Antennas will be directed on three sector headings: 15, 135 and 255 degrees, respectively. The system will operate in the 1900 MHz (millions of cycles per second) band.

RFS Cablewave Model APX16PV-16PVL-A antennas are to be employed. Input power to each of three sector antennas will be approximately 5.0 watts. Each antenna

concentrates the power in a single main beam. That concentration results in producing approximately 38 times (15.8 dBd) as much "effective radiated power"<sup>1</sup> as would be produced using a dipole antenna (a simple antenna consisting of a half-wavelength long single element). By concentrating power directed toward the service area intended to be served, each antenna substantially reduces power delivered to nearby areas in directions at large departures from the main beam angle. The shaping of the beam occurs in both vertical and horizontal planes. At any location, reception is principally from the antennas of one sector.

All calculations shown herein of RF exposure from the facility were made on the basis of maximum effective radiated power. At six feet above ground immediately below the antennas, the RF exposure will be less than 0.002 percent of the maximum RF exposure permitted ("MPE") by FCC rules for the general population. At the outer surface of the school closest to the monopole and six feet above ground, the RF exposure will be less than 0.02 percent of the MPE. A tabulation of maximum exposure versus distance at six feet above ground for horizontal distances from 10 to 4000 feet follows on the next page:

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<sup>1</sup> Effective radiated power is equal to the product of the input power to the antenna and the gain of the antenna. Gain is a measure of the effectiveness of the antenna to concentrate power into a single main beam.

*JULES COHEN, P.E.*  
*Consulting Engineer*

T-Mobile Site WAN143

Page 3

Distance <sup>2</sup> (feet)	Pwr. Density ( $\mu\text{W}/\text{cm}^2$ ) <sup>3</sup>	% of FCC MPE	Times Below MPE
10	0.015	0.0015	65,000
20	0.021	0.0021	48,000
40	0.120	0.0120	8,500
60	0.150	0.0150	6,900
100	0.120	0.0120	8,500
200	0.210	0.0210	4,800
300	0.370	0.0370	2,700
400	0.340	0.0340	3,000
500	0.270	0.0270	3,700
600	0.190	0.0190	5,300
700	0.110	0.0110	9,000
800	0.085	0.0085	12,000
900	0.060	0.0060	17,000
1000	0.043	0.0043	23,000
1500	0.017	0.0017	58,000
2000	0.0086	0.00086	120,000
3000	0.0034	0.00034	290,000
4000	0.0019	0.00019	520,000

<sup>2</sup> Distance from antenna support pole.

<sup>3</sup> Microwatts (millionths of a watt) per square centimeter.

Power density does not drop off uniformly as the distance increases because the antenna concentrates energy toward the horizon. At close distances, the amount of signal suppression counteracts the distance factor. At greater distances, the direct ray toward the location of interest more closely approaches the maximum of the antenna pattern. At some distances, the increased transmitted signal strength is a greater factor than the increased distance. Beyond about 700 feet, power density drops off uniformly.

Exposure levels were calculated by methods prescribed by the FCC in a technical bulletin produced by the Office of Engineering and Technology. The rules specify different levels of exposure for two environments: (1) Occupational/Controlled and (2) General Population/Uncontrolled. The second category permits the exposure at most frequencies, including those used for the personal wireless services, to be only one-fifth of the levels permissible for the first category. All exposure environments considered herein are assumed to be in the second category. At 1900 MHz, the maximum exposure level permitted is  $1000 \mu\text{W}/\text{cm}^2$  averaged over a period of 30 minutes for the General Population/Uncontrolled environment. The maximum exposure from the T-Mobile system, calculated for any distance is at least 2,700 times lower than the maximum permitted exposure.

In making the foregoing calculations, the assumption was made that a reflecting surface was causing the exposure to be increased because the reflected signal was arriving in phase with the direct ray. The reflected signal could just as well arrive out of phase and act to reduce the exposure. Furthermore, the assumption was made that no

intervening terrain obstructions, foliage or manmade structures reduced received signal strength.

The standard adopted by the FCC follows the maximum exposure limits set by the National Council on Radiation Protection and Measurements ("NCRP"), with some features taken from Standard C95.1/1992 of the American National Standards Institute/Institute of Electrical and Electronics Engineers. The NCRP is an expert group chartered by Congress.

The permissible exposures set, even for the Occupational/Controlled environments are not at the threshold where biological harm may result. They are based on the scientific, peer-reviewed literature, including a data base of in excess of 10,000 papers, reporting experimental results. Studies show that the most sensitive indicator of a biological effect is behavioral. When animals are trained to do a particular task, their performance of that task is modified when exposure is equal to a level approximately ten times greater than the maximum exposure permitted for the Occupational/Controlled environment and fifty times greater than the exposure permitted for the General Population/Uncontrolled environment. Behavior modification is not necessarily harmful and disappears when the field is reduced, but the assumption is made that prolonged exposure in excess of the level causing behavioral modification might be harmful.

Continuous exposure at the levels cited above is well within the maximum exposure level permitted by the standards. Those standards are premised on avoidance of RF exposure that may have an adverse biological effect.

*JULES COHEN, P.E.*  
*Consulting Engineer*

T-Mobile Site WAN143

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Jules Cohen, P.E.

October 10, 2006



## EXHIBIT "D"

Enterprise  
V5.0.2AIRCOM  
INTERNATIONAL

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## WAN143C Coverage @ 50'

RFS APX16PV-16PVL antennas were used.

Thu Apr 12 10:49:11 2006

## Best Server

GSM-Default

- 70.0 <=x dBm In Building (Comm)
- 76.0 <=x <-70.0 dBm In Building (Res)
- 84.0 <=x <-76.0 dBm In Vehicle
- 92.0 <=x <-84.0 dBm On Street

UL

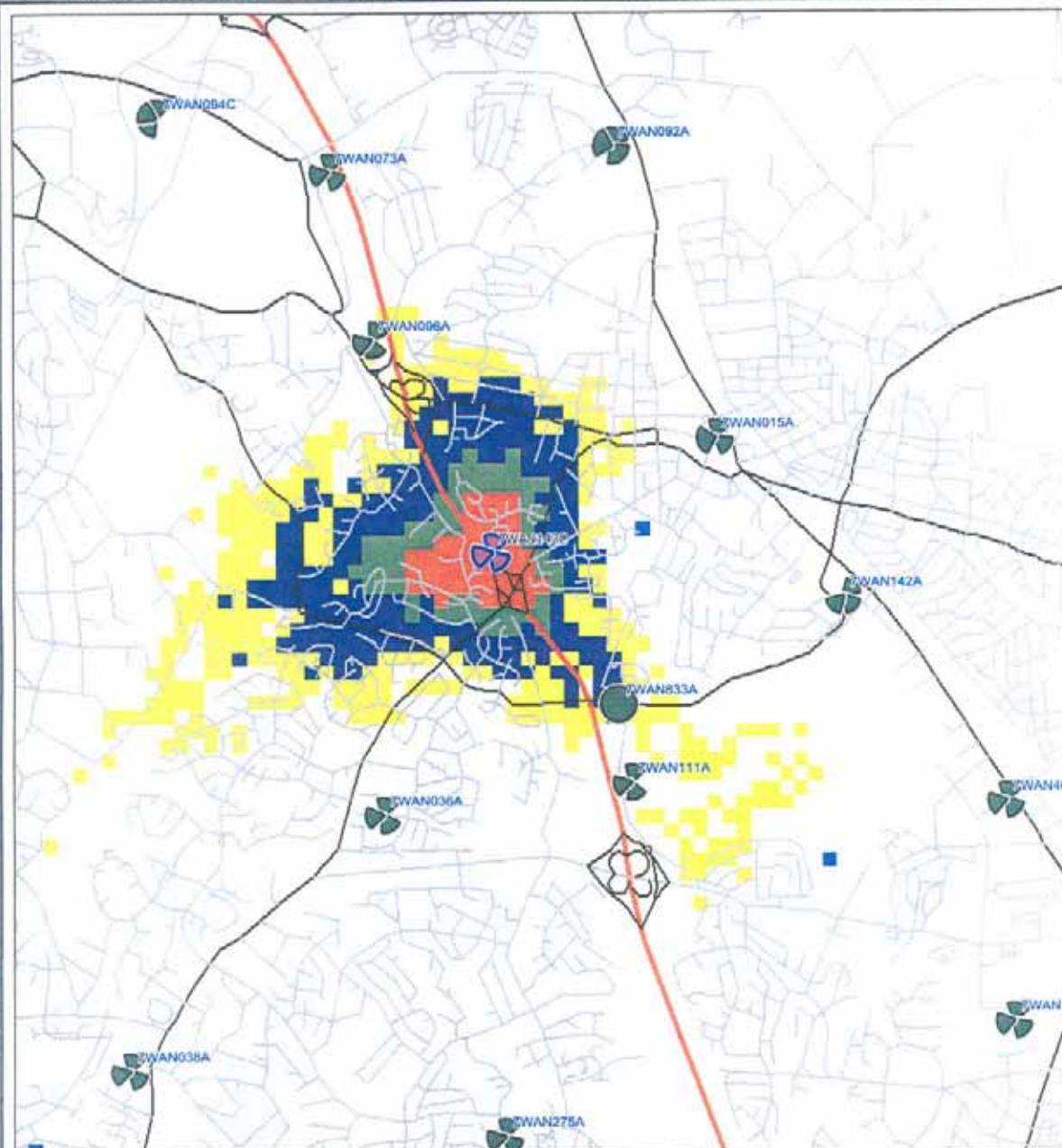
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— Interstates\_VA

— Primary\_Highways\_VA

— Secondary\_Highways\_VA

— Streets\_VA

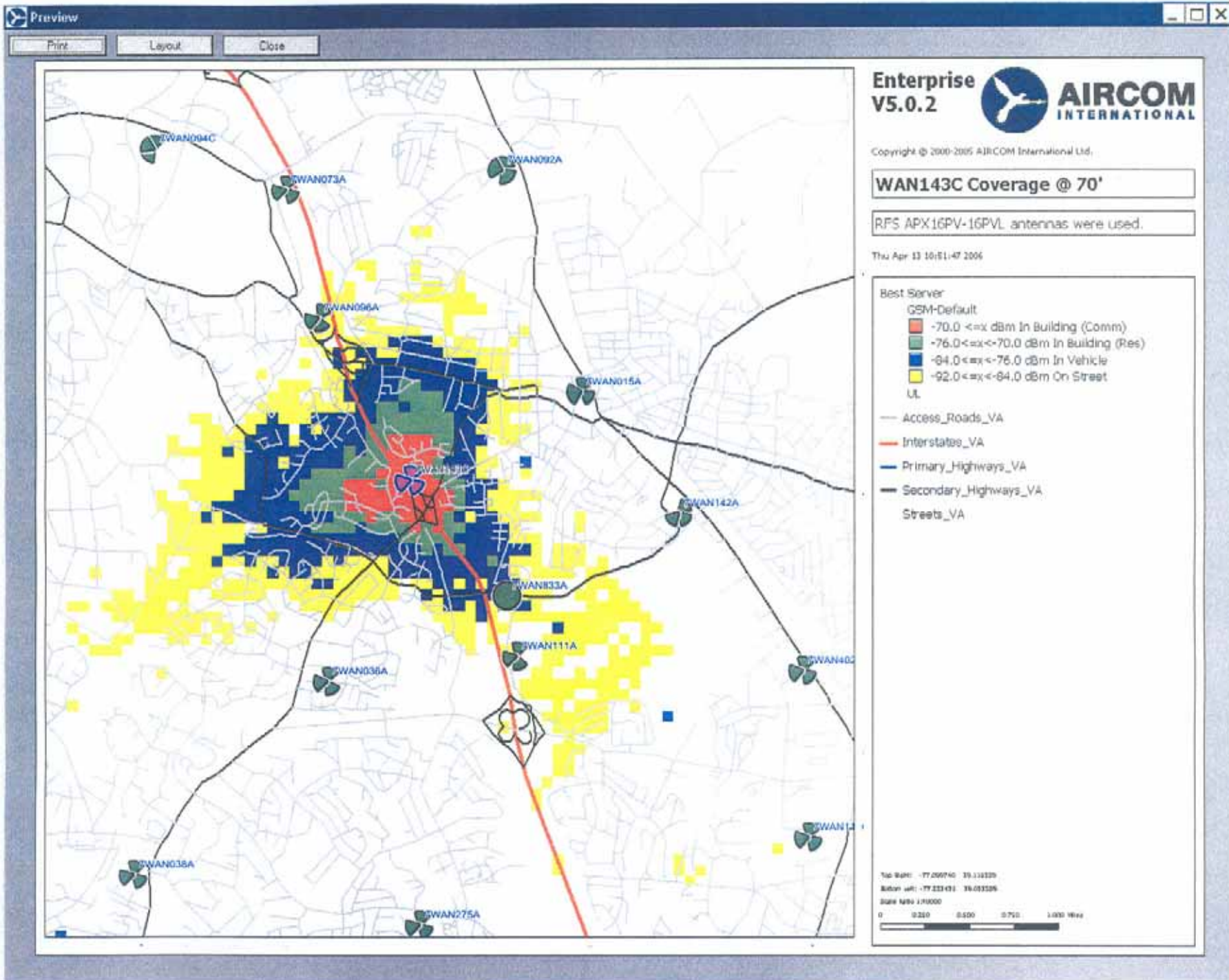


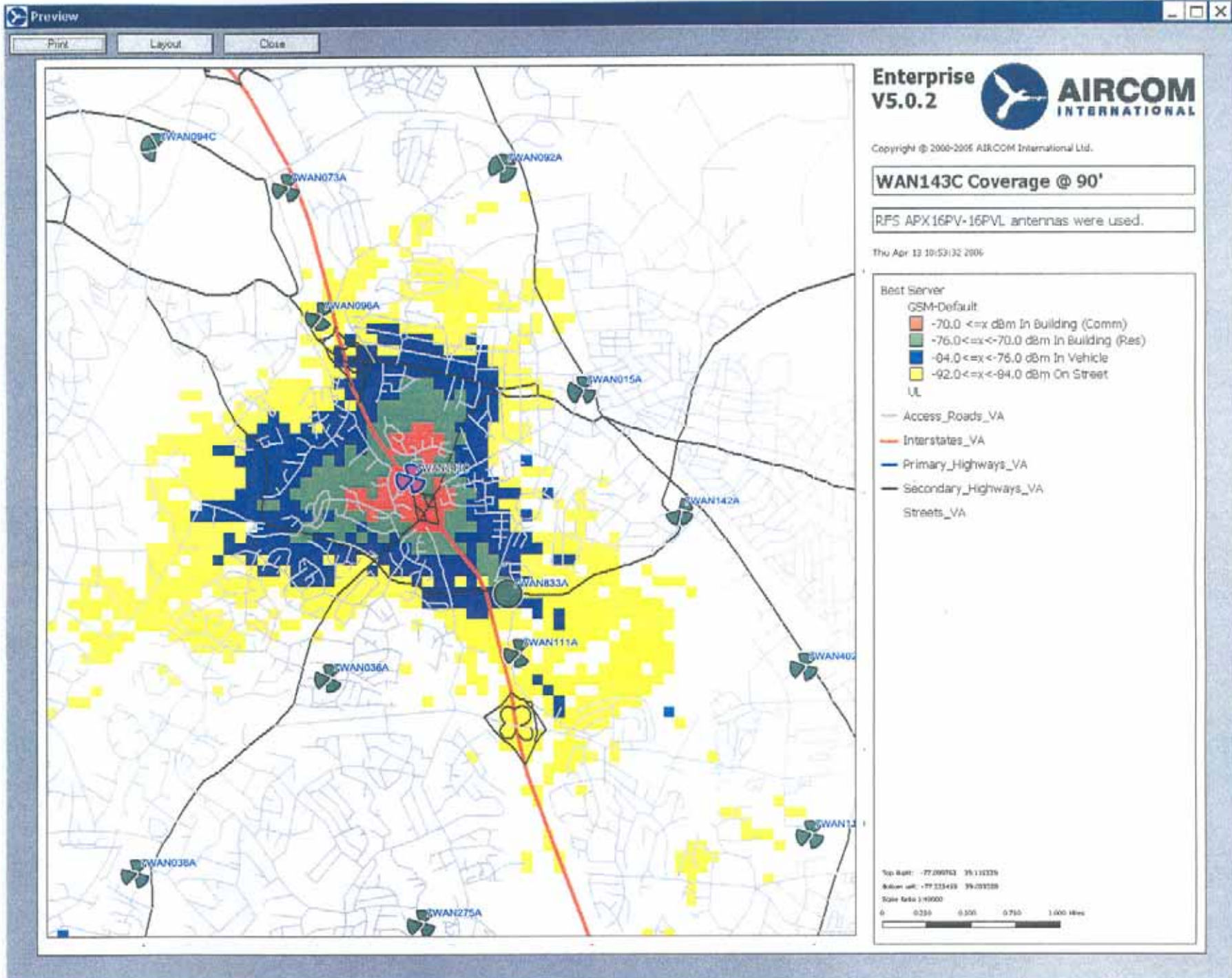
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Bottom MGRS: 17TJH9715 29J113320

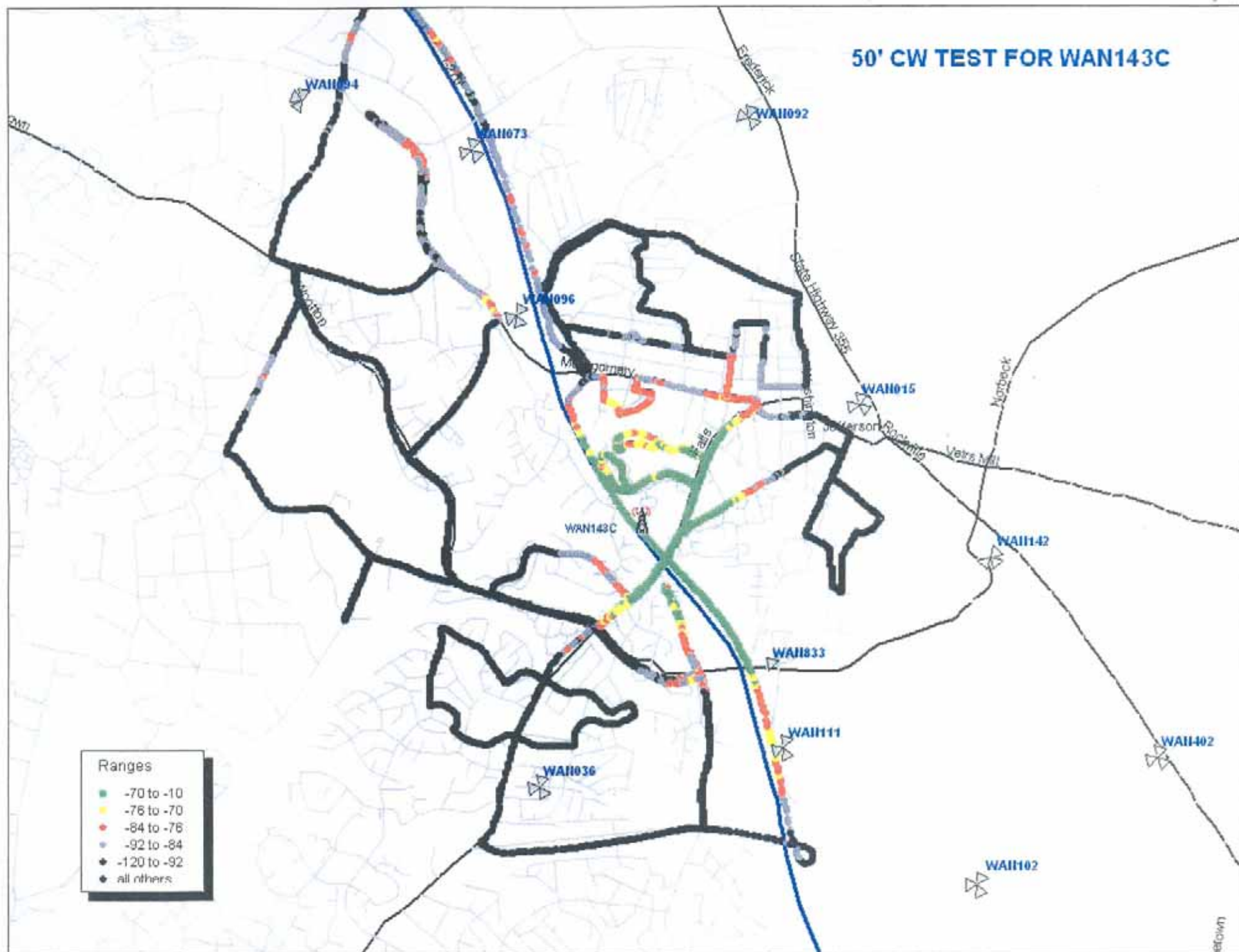
Scale Factor: 1.00000

0 0.250 0.500 0.750 1.000 Miles





# 50' CW TEST FOR WAN143C



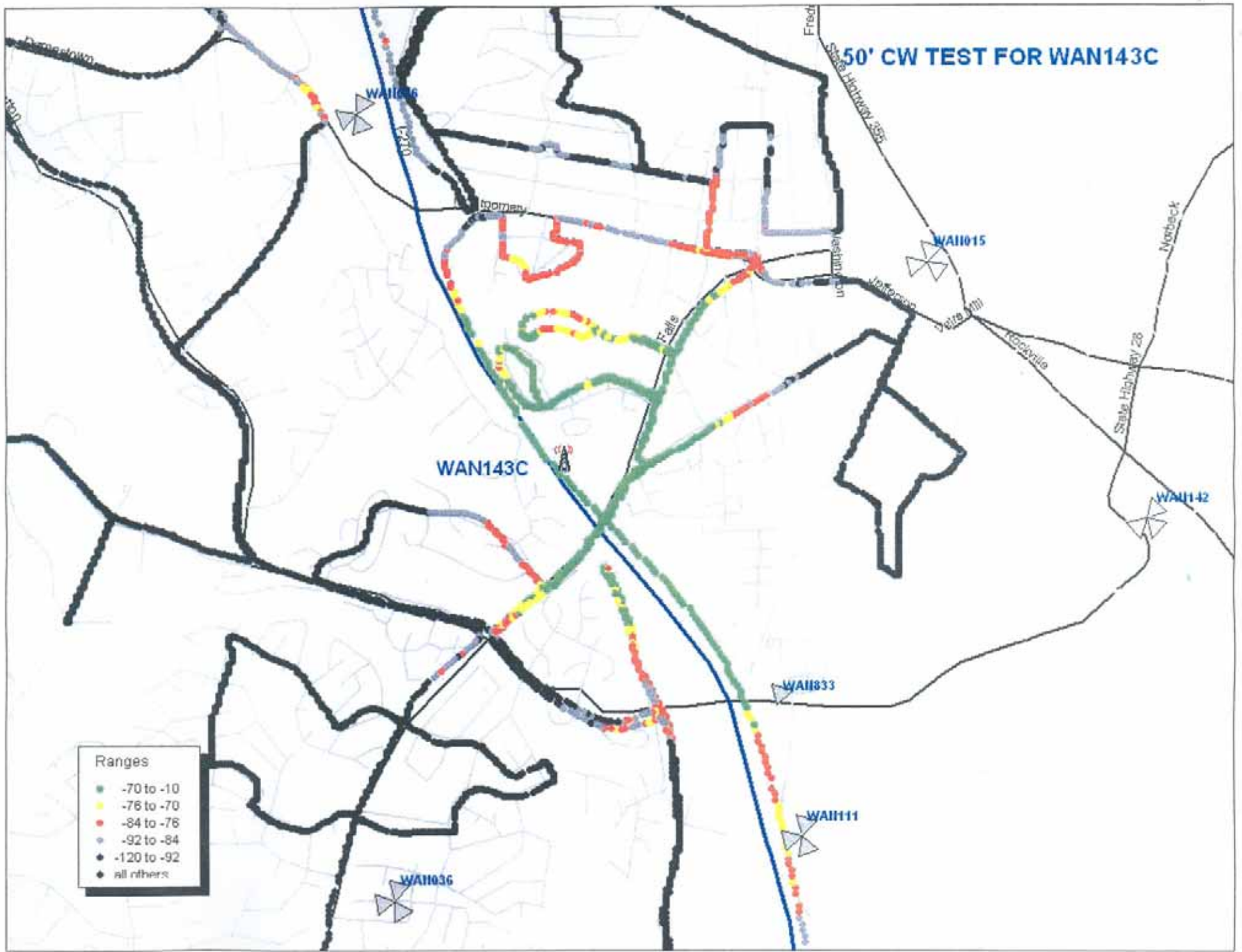
# 50' CW TEST FOR WAN143C



WAN143C



# 50' CW TEST FOR WAN143C

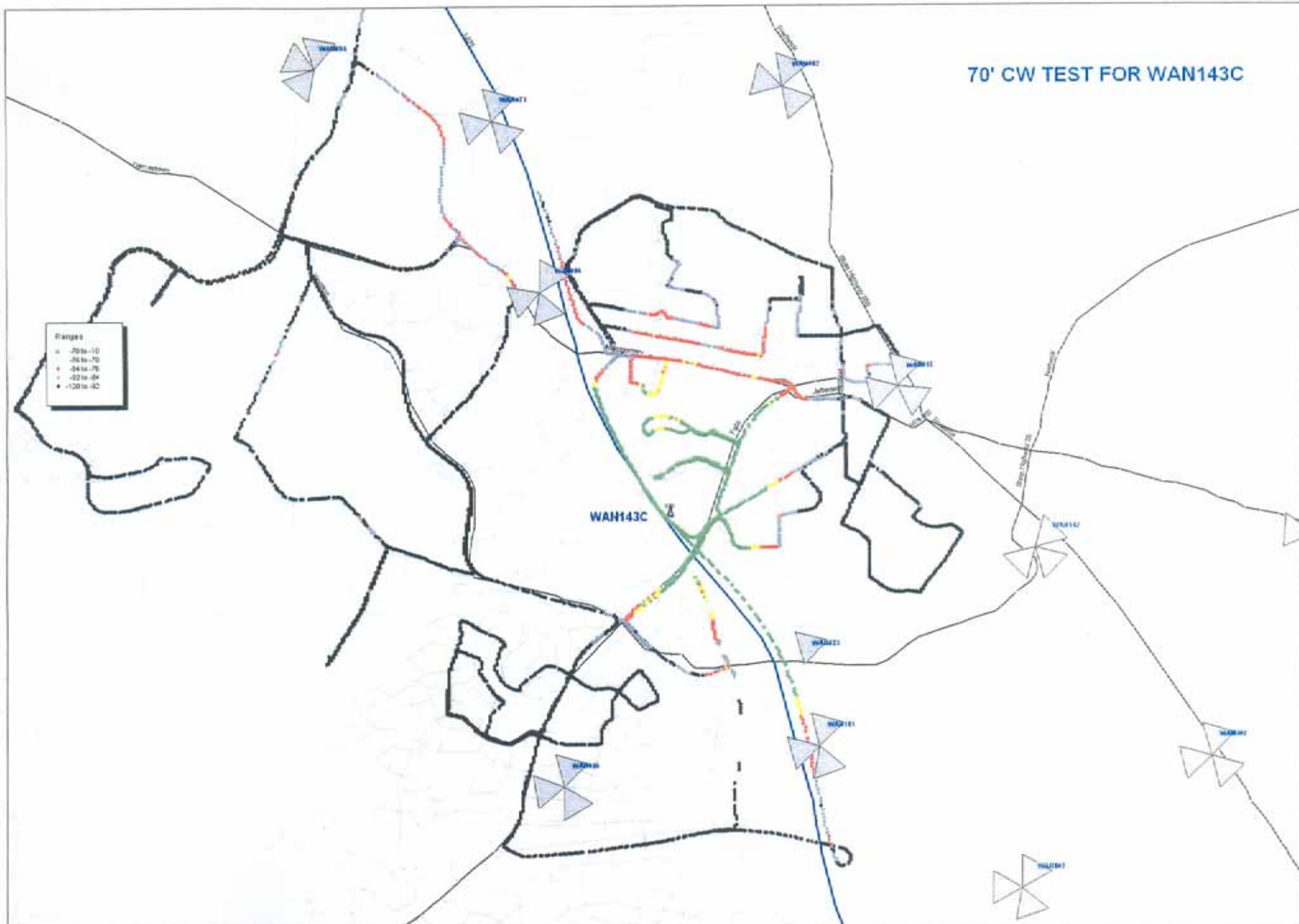


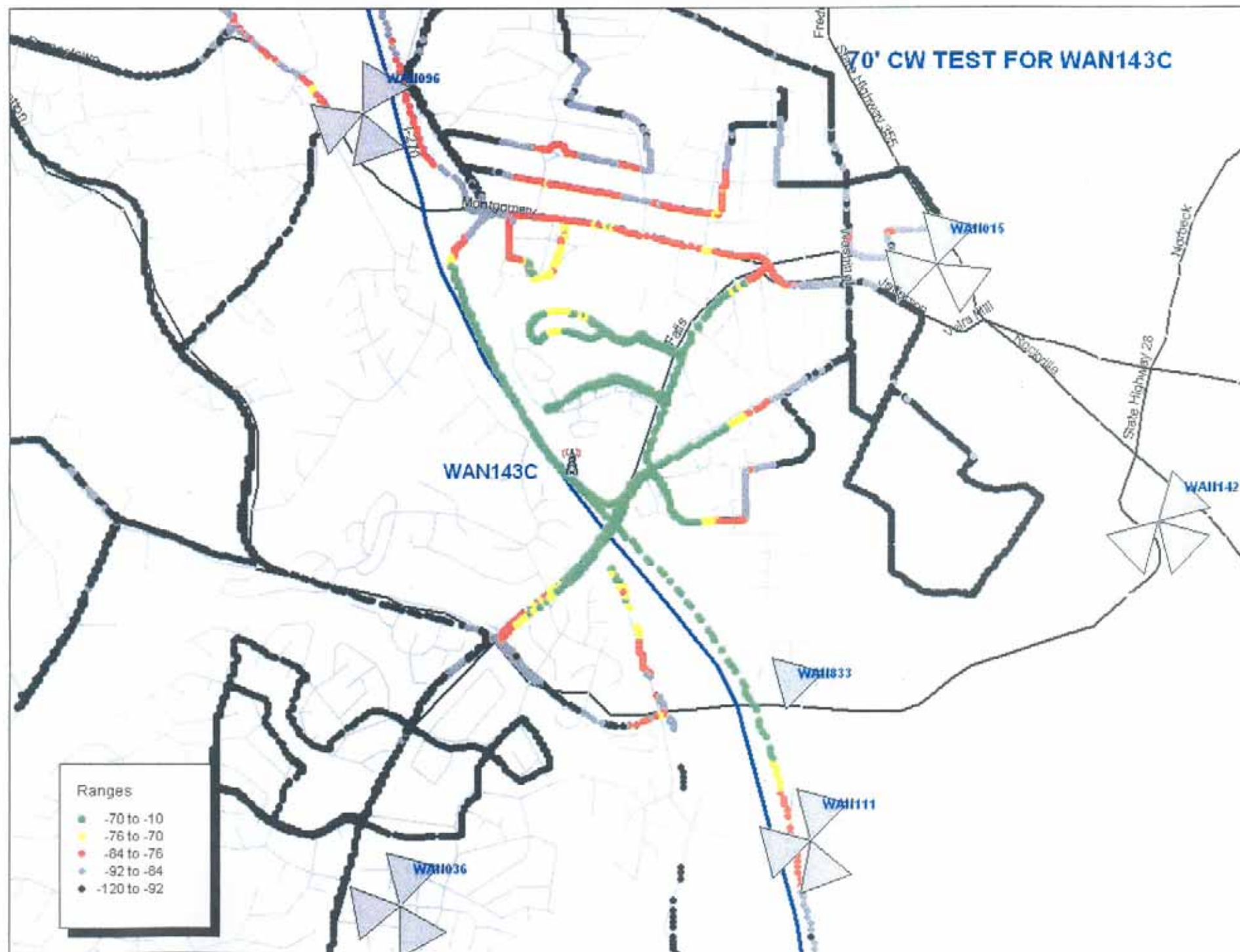
# 70' CW TEST FOR WAN143C

WAN143C

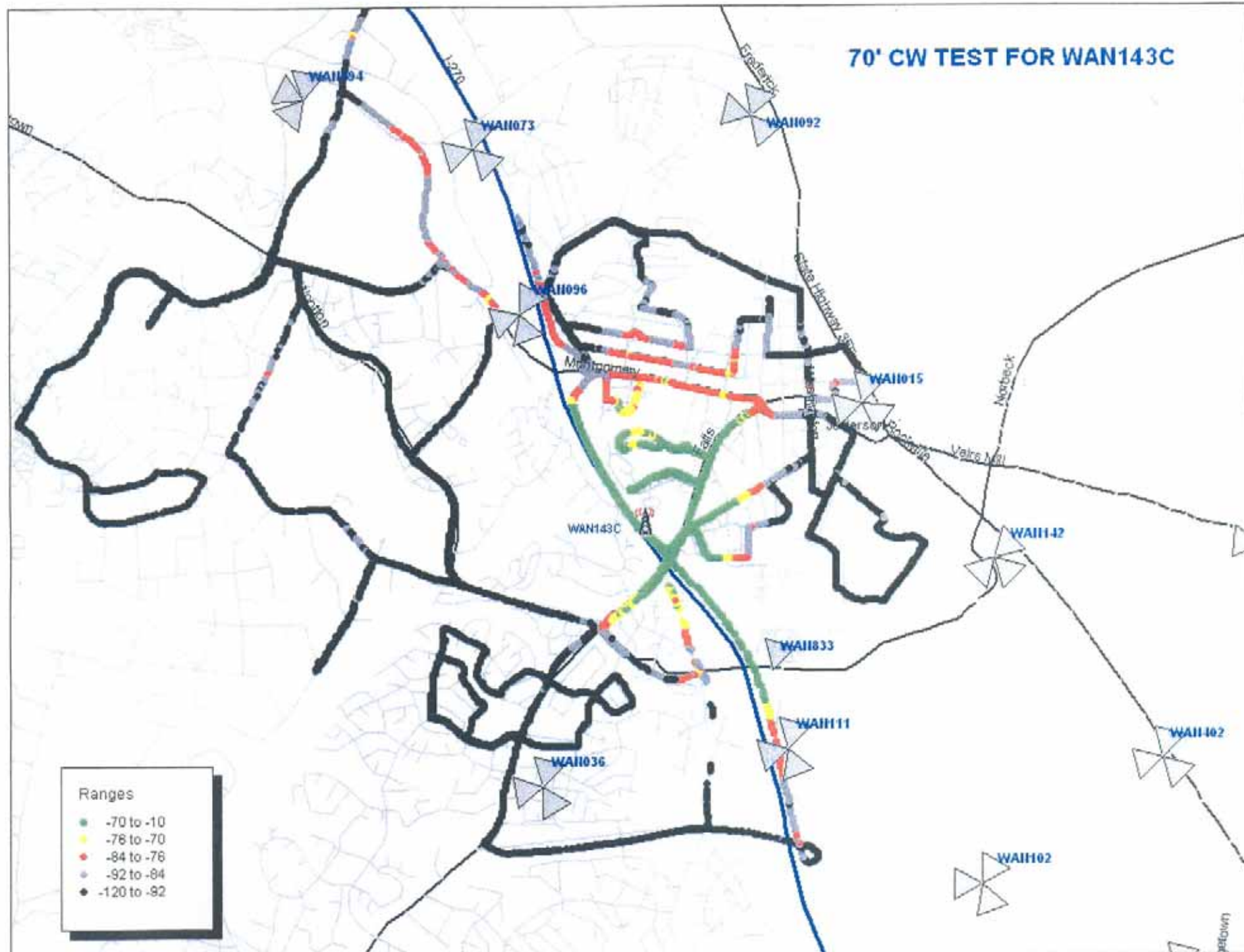
Range

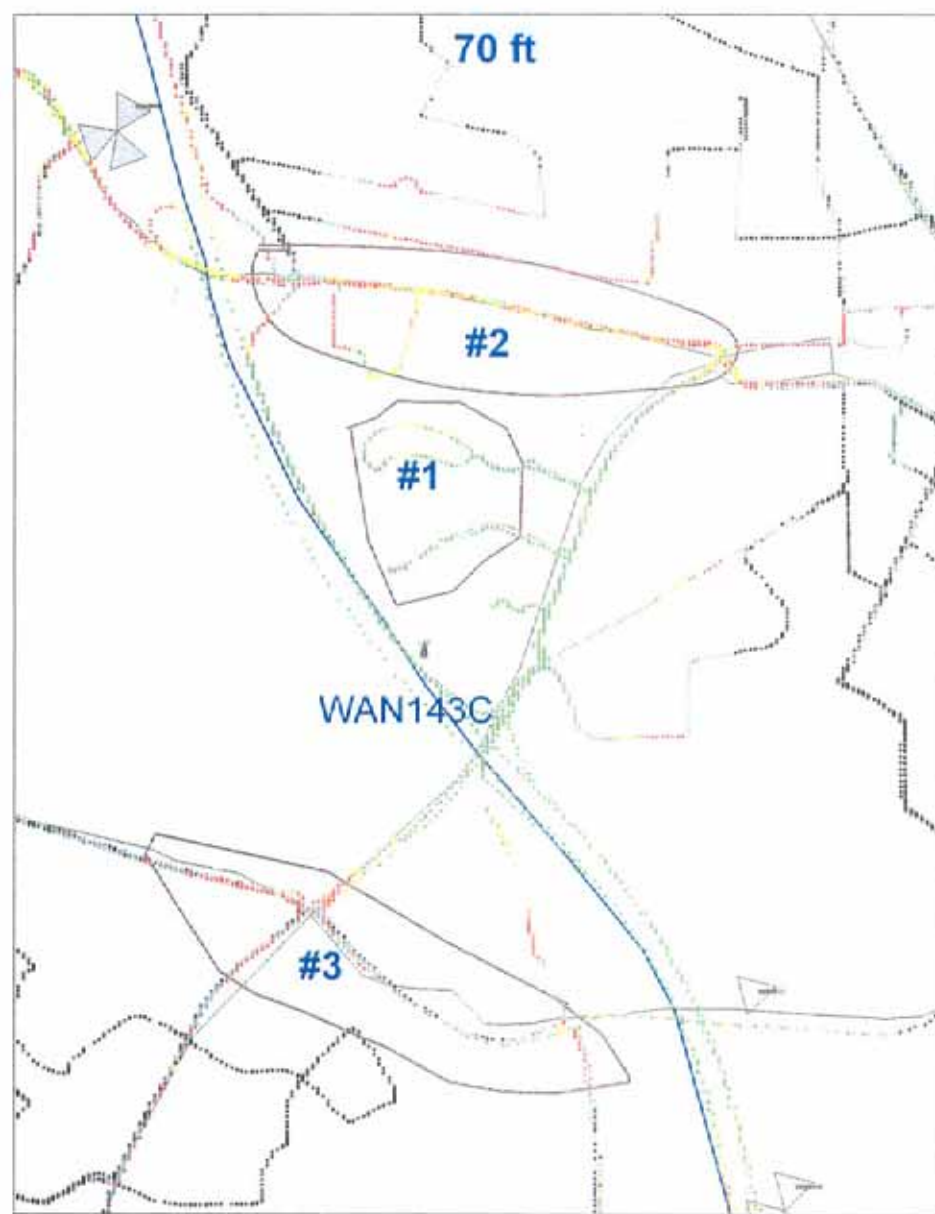
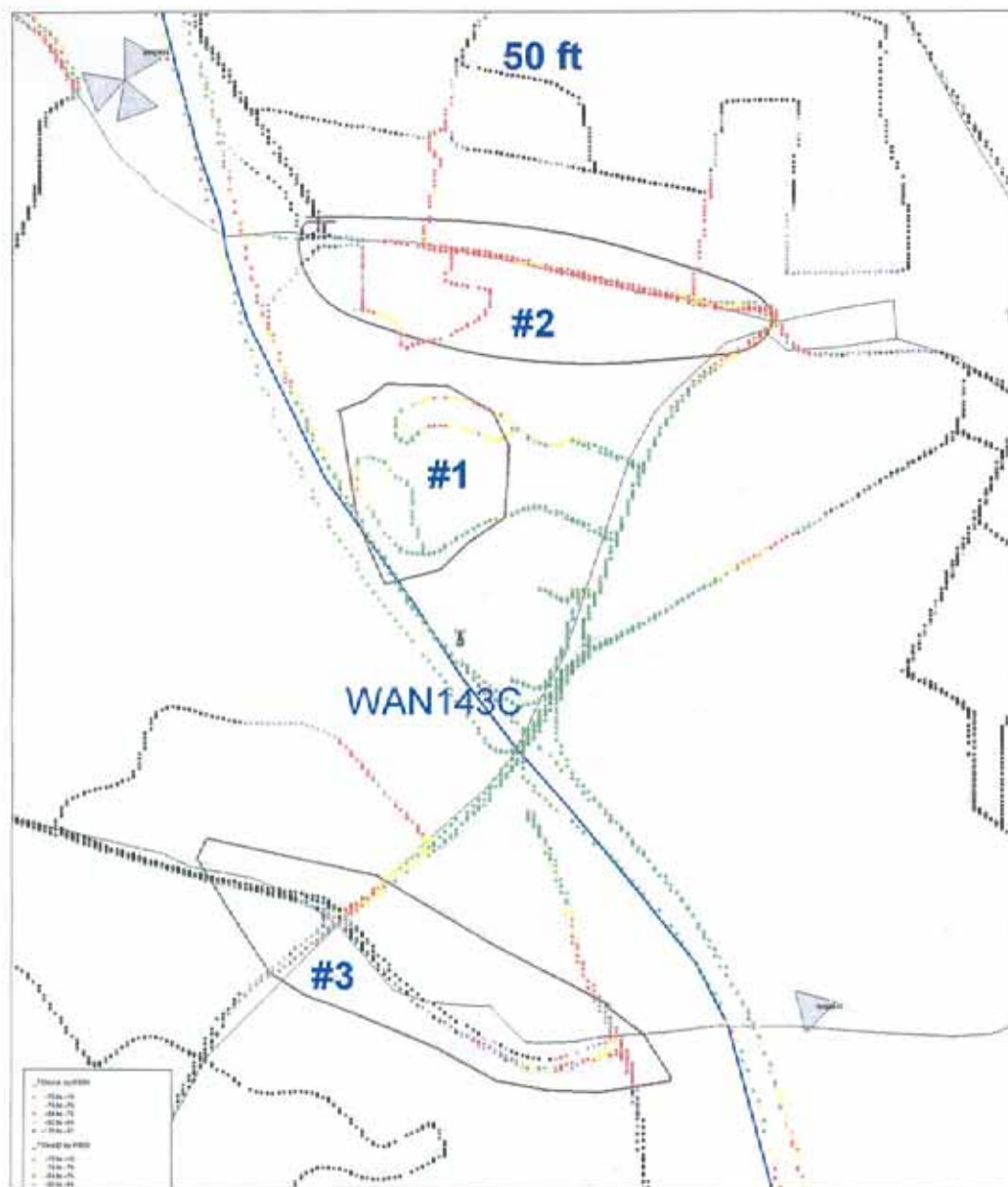
- .75 to .10
- .75 to .70
- .64 to .75
- .62 to .64
- .100 to .62



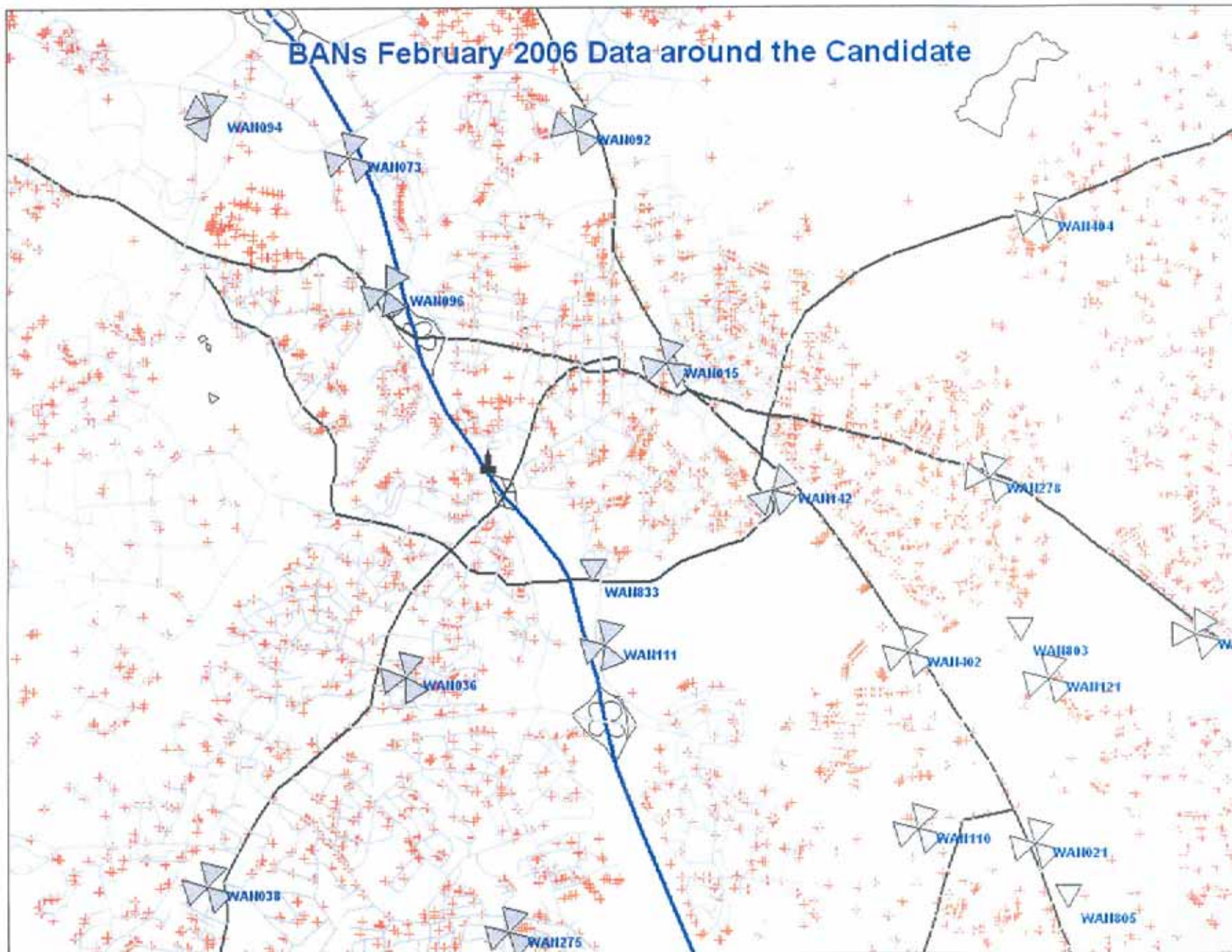


# 70' CW TEST FOR WAN143C






# BANs February 2006 Data around the Candidate



## EXHIBIT "E"



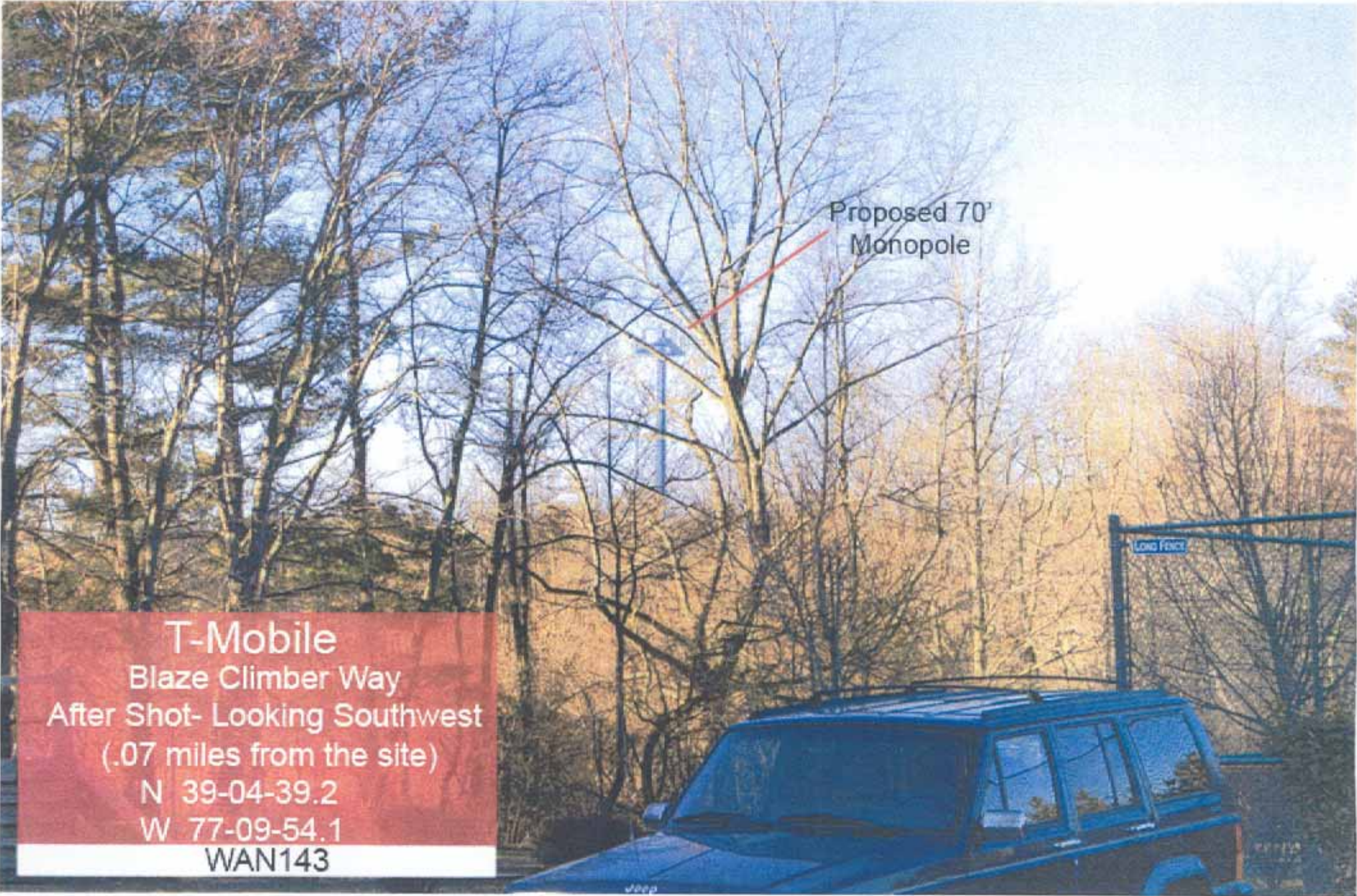


T-Mobile  
Blaze Climber Way  
Before Shot- Looking Southwest  
(.07 miles from the site)

N 39-04-39.2


W 77-09-54.1

WAN143



Proposed 70'  
Monopole

T-Mobile  
Blaze Climber Way  
After Shot- Looking Southwest  
(.07 miles from the site)  
N 39-04-39.2  
W 77-09-54.1  
WAN143



**T-Mobile**  
270 South- Looking East  
Before Shot  
(.08 miles from the site)  
N 39-04-34.6  
W 77-10-01.9  
WAN143



Proposed 70'  
Monopole

**T-Mobile**  
270 South- Looking East  
After Shot  
(.08 miles from the site)  
N 39-04-34.6  
W 77-10-01.9  
WAN143

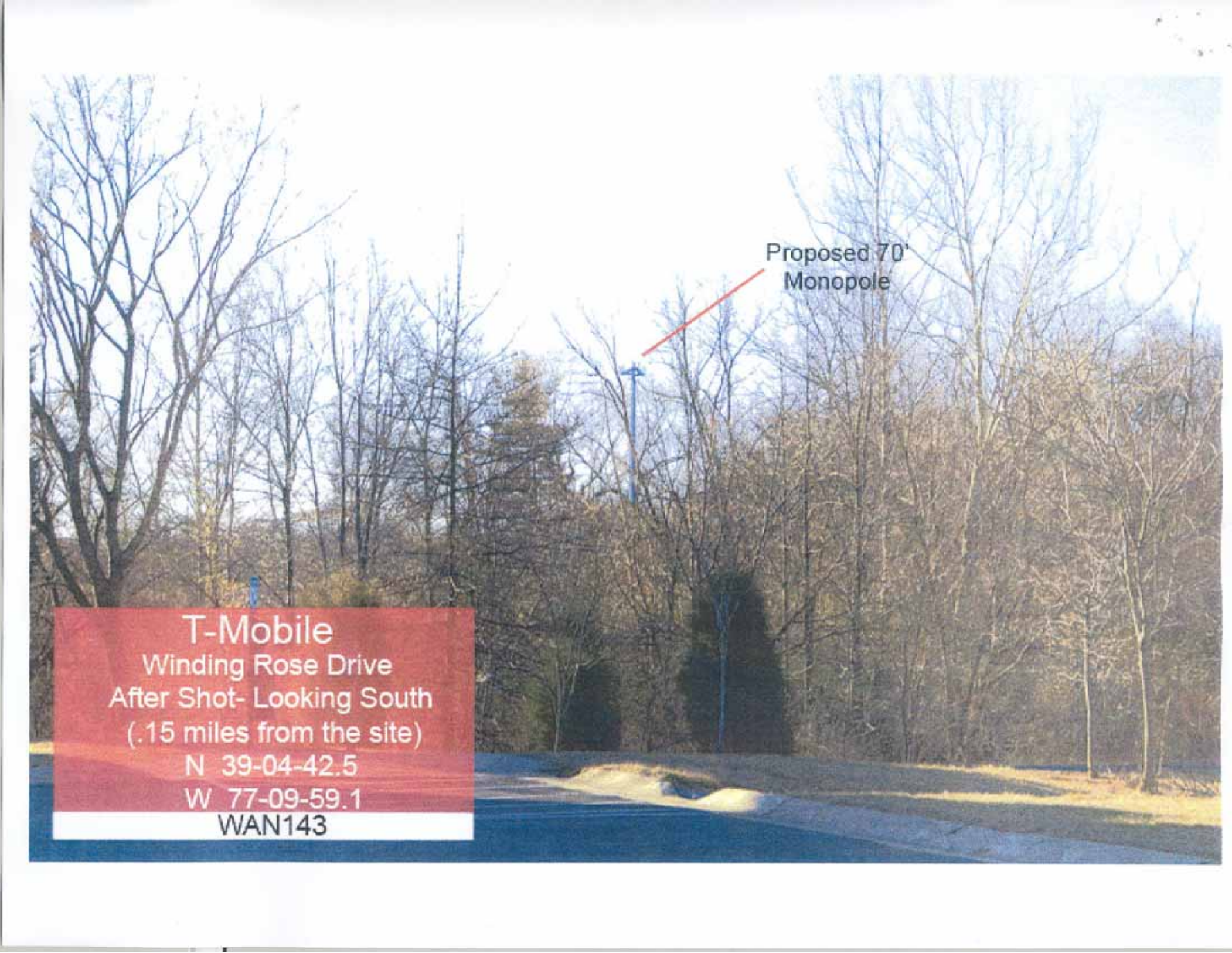


**T-Mobile**  
Winding Rose Drive  
Before Shot- Looking South  
(.15 miles from the site)

N 39-04-42.5

W 77-09-59.1

WAN143



Proposed 70'  
Monopole

**T-Mobile**

Winding Rose Drive  
After Shot- Looking South  
(.15 miles from the site)

N 39-04-42.5

W 77-09-59.1

WAN143

## EXHIBIT "F"

**NADIR KHAN**  
20268-200 River Ridge Terrace,  
Ashburn, VA 20147  
Phone: (703) 723 9353  
[Nadir.Khan@T-Mobile.com](mailto:Nadir.Khan@T-Mobile.com)

## **OBJECTIVE**

A challenging job that demands perfection and at the same time acknowledges and rewards hard work.

## **QUALIFICATION**

- Six years of hands on experience as RF Design & Optimization Engineer with T-Mobile.
- Highly self-motivated and have an ability to work under pressure. Excellent Corporate presentation skills.
- Intensely dedicated and a team player.

## **PROFESSIONAL EXPERIENCE**

### **Senior RF Engineer** June 2000 – Present

#### **T-Mobile**

- Conduct propagation modeling, configuration analysis, field-testing and performance monitoring.
- Design and implementation of T-Mobile's GSM network. Cell site need determination and engineering of new cell sites into existing network.
- To provide support to Site Development/Zoning Depts. Analyzing propagation model data and field test data.
- Bringing new sites On-Air and post evaluation of parameters and their subsequent monitoring. Turning up new sites and parameter/neighbor changes.
- Attendance of caravans, technical team visits and all other site related visits i.e. sweep tests, testifying at hearings etc. Generation of Daily, Weekly Reports and Corporate Maps.
- Review traffic statistics and utilize results in making engineering decisions. Respond to customer trouble reports and formulate long term solutions. Coordinate RF Engineering activities with Site Development, Field Operations and Network Engineering departments. Perform strategic technology evaluation and application.
- Lead role as ASSET administrator for Washington DC Market. Experience with market level model tuning and BSC Rehomes. Experienced in maintenance of Unix computing network running network applications.

### **Systems Engineer** February 1997 – May 2000

#### **George Washington University**

- Conducted research on End to End Networking communications systems. Research involved simulation (using BONEs, SPW, COMNET III) and real-time study of parallel and distributed applications on gigabit ATM switch, ATM signaling APIs for native ATM applications, Multimedia applications, Real-time multicast distribution.
- Conducted research for DOE's (Dept. Of Energy) Office of Declassification to develop an interactive pattern recognition program.

### **Communication Engineer** August 1993 - January 1996

#### **Pak Elektron Limited, Pakistan**

- Supervised electrical testing and trouble shooting of equipment such as transformers, switchgear, and motors.

## **EDUCATION**

MS Electrical Engineering, Telecommunications Engineering, February 1998  
**The George Washington University, Washington D.C.**

BS Electrical Engineering, Electronics & Communications, August 1993  
**University of Engineering & Technology, Pakistan**

## **APPLICATIONS**

- ACTIX, TEMS, OptPCS, Visual Basic 6.0, ASSET, MapInfo 8.0, InSite, HOMER, Microsoft Project Management

**REFERENCES** Available upon request.

## **ABIY ZEWEDE**

20212 Yankee Harbor Place  
Montgomery Village, MD 20886  
Tel: 301/ 527-9711  
E-Mail: azewde@aol.com

### **EXPERIENCE**

**Sr. RF Engineer- Zone Supervisor**, T-Mobile USA, Inc.  
Washington, D.C./Maryland/Virginia. 7/01 - Present.

*Optimization and expansion of a GSM/GPRS/EDGE network.*

Lead 7 RF Engineers in the design and integration of capacity cell sites in high traffic urban areas. Monitored daily statistics and optimized the performance of on-air sites by modifying frequency plan, neighbor relations, parameter settings, and antenna downtilt. Improved network capacity through implementation of AMR feature. Resolved customer generated RF related trouble tickets. Implemented in-building coverage solutions ranging from repeaters to multiple BTS Distributed Antenna System.

**Sr. RF Engineer**, Telnet, Inc.

Rockville, Maryland. 4/00 - 7/01.

*Optimization and expansion of a GSM1900 network.* Analyzed drive test data and daily network performance data for call drops, call blocks, and handover failures. Corrected problem areas with frequency changes, parameter adjustments, antenna replacements, and addition of radios. Modified neighbor list based on handover statistics. Prepared frequency plan for migration to a different PCS band. Reviewed RF audit report for coax cables, LNAs and antennas. Assisted with installation and configuration of repeaters and an indoor microcell. Issued search rings for expansion and capacity cell sites and evaluated candidates.

**RF Engineer (Contractor)**, Motorola/Cellular ONE, Inc.

El Paso, Texas. 1/00 - 4/00.

*CDMA optimization of new sites and performance improvement of existing sites in the cellular band.* Collected drive test data using Qualcomm MDM and post-processed data with IQ Analyzer. Identified problems by analyzing forward and reverse link messages as well as plots for Ec/Io, FER, Mobile Rx and Tx. Fixed problems such as pilot pollution, poor coverage, access failure, handoff failure, and RF loss by changing power and handoff parameters, neighbor list adjustments, and antenna downtilt or changes. Monitored hourly and daily performance statistics as well as BTS hardware status via OMC.

**Test Engineer (Contractor)**, Ericsson, Inc.

Lynchburg, Virginia. 4/98 - 12/99.

*Performed IS-136 TDMA related verification for Radio-Over-Cellular and Down-Banded-Cellular mobile terminals.* Utilized base station simulators to test basic DCCH functions, Call Setup on DTC, Over-the-Air Activation (OAA) and Programming (OAP), Intelligent Roaming, and Dual-Band, Dual-Mode Call Processing. Modified existing cellular test procedures to reflect added terminal functionality. Performed tests

and prepared trouble reports for any discrepancies found. Prepared test report, supported regression testing, and assisted in developing User Interface Specification.

**RF Engineer (Contractor)**, Communications Consulting Services, Inc. (CCS); Lombard, Illinois. 11/97 – 3/98.

1/98: Cincinnati/Dayton, OH- Performed Competitive Analysis of Cellular and PCS networks. Conducted competitive analysis drive test for an analog, a CDMA, and a TDMA network. Evaluated networks based on RSSI, voice quality, and call statistics such as percentage of successful call setup, handovers, and dropped calls.

12/97-1/98: Maracaibo, Venezuela- RF Design for a GSM 900 network. Developed link budget for in-building, in-vehicle, and on-street service. Classified RF environment after area visit. Produced preliminary design and issued search rings. Produced coverage plots based on key sites.

**Design Engineer**, Moffet, Larson & Johnson, Inc. (MLJ) Arlington, Virginia. 1/96 – 11/97.

8/97-11/97: Arlington, VA- Research and business development for LMDS. Compiled design requirements for LMDS planning tool; Researched millimeter-wave propagation behaviors.

4/96-8/97: Houston, TX- Designed and optimized a start-up GSM network. Produced preliminary design based on client's objective; Issued search rings; Evaluated and ranked site candidates; Produced coverage predictions; Performed RF constructability review; Specified antenna type, placement, and orientation; Created frequency plan and neighbor list; Performed interference analysis and tuned frequency plan.

1/96-4/96: Seattle, Washington- Conducted extensive drive testing to evaluate candidate sites for a CDMA network.

## TOOLS

**RF Design:** Aircom ASSET, *Odyssey*, *Xcalibur*, *CellCAD*, *PathPro*  
**Test/ Optimization:** OSS/CNA, *OptPCS*, *Actix Analyzer*, *TEMS*  
*Investigation*, *Metrica*, *MDM*, *CAIT*, *NMS/X*, *Plotworx*, , *IFR-1900 CSA*  
**Other:** MapInfo Professional, MATLAB

## WIRELESS TRAINING

*PCS 1900/GSM System Training (SYSTRA)*, Nokia Telecom.  
*DX-200 BSS Parameters (BSSPAR)*, Nokia Telecom.  
*CDMA System Design and Optimization*, MLJ, Inc.  
GPRS, AMR, TDOA

## PROFESSIONAL REGISTRATION

**Engineer Intern.** December 1995 - Present.  
Arkansas Board of Registration for Professional  
Engineers and Land Surveyors.

## EDUCATION

**M.S. in Electrical Engineering.** December 1995.  
**M.S. in Mathematics.** August 1994.  
University of Arkansas, Fayetteville, Arkansas.  
**B.S. in Electrical Engineering.** May 1990.  
John Brown University, Siloam Springs, Arkansas.

## REFERENCES

Available upon request.